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THE NORTH AMERICAN FAMILIES OF LEPIDOPTERA.

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The following is an attempt to present in tabular form the differences in the families of Lepidoptera which occur in the United States, to which the few well characterized Central American families of Macros have been added for completeness. None of the accepted lists have been followed strictly in family delimitation. but on the other hand none of the changes is new. The butterflies are according to the system followed by Scudder and Comstock; the Macro-heterocera follow Dyar's list with a couple of changes; the Tineids are separated along the lines laid down in various papers by Busck, with the addition of the primitive families recognized by Spuler in the European fauna.

As compared with *Dyar's list* the principal changes are the following:

The Parnassiidæ are combined with the Papilionidæ.

The Agapetidæ, Heliconidæ, Ithomyidæ, Lymnadidæ, Libytheidæ, and Nymphalidæ are combined as Nymphalidæ.

The Megathymidæ with the Hesperiidæ.

The Nycteolidæ with the Noctuidæ, following Hampson. I am not at all sure that the union is justified, but no satisfactory family characters have been developed, and a number of the genera are doubtful. The most distinct characters of the Nycteolidæ are the slender male frenulum-hook, the peculiarly enlarged and bent basal joint of the antenna, the head-vestiture, and the raised scaling. The last is shared by various Noctuids, and intergrades seem to occur in the case of the other characters. The peculiar wing-form, which seems to have first given Nycteola its family status, is not shared by our second species, *Characoma nilotica* (=*N. proteella*).

Apatelodes is transferred to the mainly tropical family Eupterotidæ, on both larval and adult characters, but it makes a very distinct subfamily, largely developed in South America. So far as I can see the Australia Chelepteryx will also belong to it, and probably other Australian genera. It seems to be one of the interesting types, like the marsupials, which have survived only in America and Australia.

Psychophora fasciata is a normal Noctuid, with large ocelli and typical trifid Noctuid venation; on the other hand, so far as I can see, Curtis' figures of *P. sabinii* represent the common arctic Hydriomenid geometer which Hulst considered it to be.

The Pyromorphidæ and Chalcosiidæ have been treated as subfamilies of the typically European family Zygænidæ. Acoloithus, of our species, might about as well be placed in the typical Zygæninæ, next to Ino, as among the Pyromorphinæ.

The following partial generic list will explain the disposition of the Tineina:

Yponomeutidæ
Simæthis
Choreutis
Allononyma
Setiostoma
Glyphipteryx
Atteva (Œta)
Yponomeuta
Plutella
Cerostoma
Trachoma
Scythris ?
Argyresthia ?
Zelleria ?
Epermenia ?
Schreckensteinia ?
Gelechiidæ
as in Dyar's list
Œcophoridæ
as in Dyar's list
also Eido
Endrosis
but not Ethmia
Ethmiidæ
Ethmia

Stenomatidæ
Stenoma
Ide
Brachiloma
Blastobasidæ
as in Dyar's list
exc. Endrosis
Cosmopterygidæ
Coleophora ?
Batrachedra ?
Cosmopteryx
Lymnæcia
Stilbosis
Mompha (Laverna)
Walshia
Theisoa (Cacelice)
Chrysopeleia
Psacaphora
Leucophryne
Erineda ?
Elachistidæ
Elachista
Heliozelidæ
Heliozela
Antispila

Cycloplasis ?
Coptodisca ?
Douglasia ?
Tinagma ?
Heliodinidæ
Heliodines
Acrolepiidæ
Acrolepia
Gracilariidæ
Chilocampyla
Acrocercops
Parectopa
Gracilaria
Lithocolletis
Cremastobombycia
Ornix
Leucanthiza
Marmara
Lyonetiidæ
Bedellia ?
Proleucoptera
Philonome
Lyonetia
Phyllocnistis
Bucculatrix ?

Tineidæ
Argyresthia ?
Zelleria ?
Monopis
Tinea
Trichophaga
Tineola
Scardia
Xylesthia
Amydria
Setomorpha
Anaphora
Acrolophus
Hypoclopus
Pseudanaphora
Tischeriidæ
Tischeria
Coptotriche
Opostegidæ
Opostega
Nepticulidæ
Nepticula
Ectodemia
Trifurcula
Adelidæ
Incurvaria
Brackenridgia
Cyane ?
Isocorypha?
Graya ?
Nemotois
Adela
Prodoxidæ
Prodoxus
Pronuba

I acknowledge considerable help from Mr. Busck in this part of the table, and regret he was unable to take time to contribute the Tineina as a whole. The interrogation points indicate some of the principal points where the family positions are uncertain, either from lack of study of dissections, or from failure to develop characters of true family rank. Most of the genera I have not seen I have simply omitted from the list, unless their position was quite evident. The Heliozelidæ, as they stand here are heterogeneous, with little doubt. Part of the genera may be distributed among the recognized families, while some may need to become typical of new ones. There are indications of a connection between Tischeria, Opostega and this group, through such forms as the Old-world genus Opogona, which may or may not be significant. Opostega is certainly aculeate, Tischeria has structures corresponding to aculeæ, but so enlarged and modified that their status is doubtful, while I am unable to see any at all in Antispila. The whole range of structure in the five families Gelechiidæ to Blastobasidæ is hardly as significant as that within the Tineidæ, even as here restricted.

The principal difference from the arrangement in *Comstock's Manual* is the treatment of the Tortricina, Geometrina and Pyralidina; (except the feathered forms) each as a single family. His Cymatophoridæ is the Thyatiridæ of this table, and his Zygænidæ are here called Syntomidæ, following general European usage in treating Zygæna as the group related to Pyromorpha. The Auzatidæ have been combined with the Drepanidæ (Platypterygidæ).

Kirby's Bibliography is so different in its treatment of family

lines that a detailed comparison is not worth while; for instance his Lasiocampidæ are here divided among the Saturniidæ, Lonomiidæ, Eupterotidæ, Lasiocampidæ, and Megalopygidæ, members of most of which also occur in others of his families.

The characters used are in general familiar, and fully explained, for instance, in Smith's Glossary of Entomology, but the following points may not be clear. The "quadrifid" venation is that in which M_2 and M_3 are so closely associated with the stem of cubitus as to appear more or less dislocated branches of it, as well as the two true branches of cubitus; in the trifid venation only M_3 is associated with cubitus, and M_2 is free, associated with the radial stem, or lost; of course in primitive forms, where the medials keep their basal connection direct, the cubitus has only the two branches that properly belong to it.

When only one pair of palpi are developed they are the labial; but in a few primitive forms, such as Prodoxus, the maxillary palpi are the larger and more conspicuous—they can be easily distinguished by their attachment to the tongue, and in these primitive forms by their larger number of joints (5) and free movability, being folded near the middle in repose, and usually in dead material.

Aculeæ are minute spinules scattered over the wing-membrane. They are several times as numerous as the scales, but so small as only to be visible with higher powers of the microscope, and being covered by the scales can only be seen in bleached and stained or denuded wings. In the Micropterygidæ, Hepialidæ, Prodoxidæ, Adelidæ and Nepticulidæ they are generally distributed; in the Heliozelidæ, Tischeriidæ and Opostegidæ they are mostly in the region of the base of the cell of the fore wing, and somewhat difficult to find; while in all the other Lepidoptera they are absent, except for a patch of enlarged modified ones near the base of the inner edge of the fore wing.

The antennæ in the great majority of Lepidoptera have regularly imbricated scales on the upper side of the shaft, while the sides, pectinations when present, and under side are covered only with minute sensory hairs. In the lowest families, however, such as the Tineidæ, the whole surface is scaled, and on the other hand the Saturniidæ have lost all the scales except on the basal joint.

At the base of the abdomen, on each side, there is a large cavity, which, to judge by its position and gross structure, is probably auditory in function. This is called the tympanic cavity here, and its outlet, which lies at the boundary between thorax and abdomen, the tympanic opening. Usually it is high up, about on the level of the wings in a spread specimen, but in the Geometridæ it is lower, and generally very conspicuous. In the Pericopidæ, where it is also particularly large, it is as high as in most families, and projects slightly above the general surface of the abdomen.

In counting the number of anals in the fore wing (alternative No. 8) an imperfect and rudimentary first anal, which only forms a short bar near the margin, is often met; in the Macros (forms with the wing-membrane three or four times as wide as its fringe or more, and generally hairy or deep vestiture) such a rudiment is not counted; in the Micros (where the wing-membrane is not more than twice as wide as its fringe, and the vestiture, except on the head, is scaly) it is. Doubtful cases have generally been entered twice in the table, but no attempt has been made to make the part referring to the Tineina complete.

Table of Families.[1]

1. Winged 2
1. Wingless 52
2. Hind wings with four or five radials, with at least ten veins besides anals, wing-membrane spinulated 3
2. Hind wings with only one free radial (two in the otherwise much reduced Douglasia group); with at most six (or with Sc, 7) veins from cell 4
3. Wings hardly wider than their fringe, expanse about one-half inch ..... MICROPTERYGIDÆ
3. Wings ample, fringe narrow, expanse over one inch ..... HEPIALIDÆ
4. Each wing deeply cleft into six narrow strips ..... ORNEODIDÆ
4. Fore wing moderately cleft into two, and hind wing deeply into three feathers ..... PTEROPHORIDÆ
4. Wings entire, or fore wing only, moderately cleft 5
5. Inner margin of fore wing and costal margin of hind wing narrowly folded, and interlocking; fore wing at least four times as long as wide, and base, at least, of hind wing transparent ..... ÆGERIIDÆ
5. Wings not interlocking at middle of margin, very rarely transparent, and if so with broader fore wings 6

[1] The New England families are indicated by small capitals.

6. Hind wing lanceolate, without marked anal angle, or notched below apex and trapezoidal; the fringe almost as wide as wing, or wider. . TINEINA in part 55
6. Hind wings much broader than their fringe, never lanceolate and rarely trapezoidal with produced apex 7
7. A double series of enlarged and divergent scales along Cu of hind wing below *Pterophoridæ* (*Agdistinæ*)
7. No such specialized scales 8
8. Fore wing with two anals at margin 9
8. Fore wing with only one anal reaching margin, 1st A rudimentary, or represented by a fold; 3d A at most by a short spur 15
9. Antennæ strongly clubbed . . . . . *Castniidæ*
9. Antennæ tapering regularly 10
10. Sc and R of hind wing independent, parallel, connected by a strong cross-vein near middle of cell or beyond 11
10. Sc arising from cell near middle (sometimes free also for a short distance near base . . . . . EUCLEIDÆ
10. Sc arising near tip of cell 14
10. Sc arising separate from R, running closely parallel to it to well beyond end of cell, or fused with it beyond end of cell; the base of R in that case either complete, showing as a short spur, or lost . . . . . PYRALIDIDÆ in part
10. Sc. entirely independent of R, or connected by a weak cross-vein, or one near base of wing, Sc and R sharply divergent before end of cell, TINEINA in part 55
11. Fore wing with accessory cell 12
11. No accessory cell 13
12. Wings lanceolate, strong; body heavy, far exceeding the hind wings when spread . . . . . COSSIDÆ
12. Wings ample, rounded, body short and slender . . . . . *Dalceridæ*
13. Tongue developed, palpi scaled . . . . . *Zygænidæ* (*Chalcosiinæ*)
13. Tongue absent, palpi small and hairy or absent . . . . . most PSYCHIDÆ (♂s)
14. R 5 long-stalked, colors light, the northern species with crinkly hair on fore wing . . . . . MEGALOPYGIDÆ
14. R 5 from cell, dark, smoothly scaled forms . . . . . ZYGÆNIDÆ (PYROMORPHINÆ)
15. Hind wing with three anals, the first often fading out toward base 16
15. Hind wing with two anals or less, at most with a short spur of 1st A at margin in broad-winged forms 17
16. Sc and R of hind wing closely parallel or fused beyond end of cell PYRALIDIDÆ in part
16. Sc and R strongly divergent from before end of cell . . . . . TINEINA in part 55
17. Antennæ distinctly swollen toward tip, and frenulum wanting, (Butterflies) 18
17. Antennæ not swollen toward tip, or if so (Agaristidæ, Sphingidæ) with a strong frenulum 23
18. Fore wing with all veins present, from cell, eyes strongly lashed in front, antennæ separated at base by a distance greater than half width of eyes HESPERIIDÆ
18. Fore wing with some radials stalked or absent, eyes rarely lashed, antennæ closer together 19
19. Hind wing with only one anal . . . . . PAPILIONIDÆ

19. Hind wing with two well-developed anals....20
20. M_2 from middle of end of cell in both wings, or obsolete, fore wing in northern species with ten or eleven veins....21
20. M_2 distinctly associated with radial stem, in one, and usually in both wings; lower discocellular vein often obsolete, with at least a trace of a humeral vein....22
21. A humeral vein in hind wing....*Erycinidæ* (*Riodinidæ*)
21. No humeral vein....Lycænidæ
22. Butterfly walking on four legs (except female of Hypatus), radius five-branched, M_1 from cell....Nymphalidæ
22. Butterfly using all its legs for walking, radius usually four-branched, M_1 stalked with it....Pieridæ
23. Our species very stout and two inches or more in expanse, the hind wings rarely reaching beyond middle of abdomen, Sc and R of hind wing connected at the middle of the cell or rather before by a vein (R_1) which is as strong as any; and then closely parallel to end of cell or beyond....Sphingidæ
23. Wings proportionately larger, Sc and R rarely connected by a strong cross vein, and if so, strongly divergent beyond it....24
24. Sc and R separate, but connected by a more or less distinct cross-vein; accessory cell fused with discal cell, but with the line of separation (R_4+_5) indicated by a slight thickening, starting from an angulation in the stem of R; species under one inch in expanse....a few Tineina 55
24. Accessory cell separated by a full-sized vein, or completely absent....25
25. Cu of fore wing apparently three-(in a couple of Lithosians two-) branched..26
25. Cu of fore wing apparently four-branched....40
26. Frenulum normal....27
26. Frenulum rudimentary (less then one fifteenth length of hind wings) or absent 33
27. Sc and R fused from base of hind wing beyond middle, swollen at the base, then rapidly diverging; very slender....Lithosiidæ in part
27. Sc and R separate at extreme base, then closely approximate or fused a greater or less distance....28
27. Sc and R sharply divergent from close to base....Uraniidæ (Epipleminæ)
28. Stout-bodied moths, the thorax at least a sixth as wide as length of fore wings 29
28. Slender moths....32
29. A strong brace vein from an angle near base of Sc to root of frenulum Geometridæ in part
29. Sc moderately thickened and curved at base....30
30. Cu apparently three-branched in hind wing....31
30. Cu apparently four-branched in hind wing....Thyatiridæ
31. Tongue wholly absent, the northern species with hyaline subterminal spots Eupterotidæ (Apatelodinæ)
31. Tongue distinct, usually strong; wings fully scaled....Notodontidæ
32. Tympanic opening at base of abdomen small and subdorsal, 1st A usually partly present, Sc of hind wing slightly bent at base and but little enlarged; the humeral angle not expanded. Usually with M_3 and Cu_1 stalked in both wings....*Dioptidæ*

32. Tympanic opening with a few exceptions conspicuous, lateral; 1st A wholly absent in both wings; Sc of hind wing sharply bent or much enlarged at base, almost always with a brace vein running across to base of frenulum ..... most GEOMETRIDÆ
33. Sc and R of hind wing fused for a very short distance, then sharply divergent, separate from base, or connected by a weak cross-vein; tympanic opening inconspicuous 34
33. Sc sharply divergent from R at extreme base, then sharply bent and touching, fusing or closely parallel to it or connected by a strong cross-vein; tympanic opening conspicuous, lateral ..... a few GEOMETRIDÆ
34. Antennæ not scaled beyond basal joint 25
34. Antennæ closely scaled on upper side 36
35. Two anals; M_1 of fore wing connate or stalked with radial stem, CERATOCAMPIDÆ
35. M_1 separate from radial stem; with only one anal, or upper discocellular vein long and longitudinal ..... SATURNIIDÆ
36. Sc of hind wing sharply divergent from R from close to base 37
36. Sc and R parallel at base, connected by a weak cross-vein 39
37. R_{4+5} widely separated from R_3 all the way from cell to margin .... LACOSOMIDÆ
37. R_4 and R_5 arising from cell closely associated with R_3 38
38. R_5 and M_1 stalked or closely approximate at base, and separate from R_4 ..... *Uraniidæ* (*Uraniinæ*)
38. R_5 separate from R_4, which may be stalked with R_3 ..... *Lonomiidæ*
39. Frenulum about one-sixteenth length of hind wing .. *Eupterotidæ* (*Eupterotinæ*)
39. Frenulum obsolescent, not exceeding humeral angle, or absent ... *Bombycidæ*
40. Cu_2 of fore wing arising from cell about a third way out from base, or even nearer base; R_5 stalked with M_1, with humeral veins in our species; no frenulum ..... LASIOCAMPIDÆ
40. Cu_2 of fore wing arising well beyond middle of cell; usually with frenulum .. 41
41. Sc and R of hind wing strong and parallel to beyond end of cell, and then approaching very close or fusing a short distance ..... DREPANIDÆ
41. Sc and R fusing before end of cell or wholly independent 42
42. Fore wing with complete venation (twelve veins) all the radials, medials and cubitals arising separately, or with R_2 and $_3$ shortly stalked ..... THYRIDIDÆ
42. R_3 and $_4$ or R_4 and $_5$ long-stalked or with some veins absent 43
43. Sc apparently absent (fused except at extreme base with R) ..... SYNTOMIDÆ
43. Sc and R separating before end of cell 44
44. Antennæ swollen toward tip ..... AGARISTIDÆ
44. Shaft of antennæ regularly tapering 45
45. Ocelli present 46
45. Ocelli absent 50
46. Sc and R of hind wing fused to middle of cell or beyond ..... most ARCTIIDÆ
46. Sc and R fused for more than a fifth length of cell, but the fusion not reaching middle 47
46. Sc and R fused for less than a fifth length of cell, the fusion sometimes imperfect 48
46. Sc and R connected by a strong cross-vein ..... a few *Lymantriidæ**

*The Hypsidæ, distinguished by the well developed tongue, are represented by an unidentified and aberrant species in the Barnes Collection.

47. Hind tarsus ordinarily not more than eight times as long as thick, often with reduced tibial spurs; M_2 reduced only in *Eubaphe;* in the rest of full strength and associate with cubital stem; moths often stout; Sc very much swollen at base.....many ARCTIIDÆ
47. Hind tarsus ordinarily much more slender, the tibia with long spurs; M_2 usually well separated from cubital stem, though nearer it than radial, and often weaker than the other veins; Sc not more than twice as thick as R in their basal portion; usually slender moths.....some NOCTUIDÆ
48. Tympanic bullæ enlarged dorsally, showing from dorsal side as two rounded bosses on the first segment of the abdomen; brilliantly marked species PERICOPIDÆ
48. Tympanic bullæ inconspicuous.....49
49. White or yellow species with palpi not reaching the middle of the smooth-scaled front, and four-branched Cu in both wings.....ARCTIIDÆ (*Haploa*)
49. Species with longer palpi, three-branched Cu in hind wings or gray ground color.....most NOCTUIDÆ
50. Fore wing with raised scale-tufts, small, with Sc and R ordinarily fused to near middle of cell but free at base.....NOLIDÆ
50. Fore wings smoothly scaled.....51
51. Sc and R of hind wings fused for a point about middle of cell, or connected by a cross-vein.....most LYMANTRIIDÆ
51. Sc and R fused from base to middle of cell.....most LITHOSIIDÆ
52. Legs lost, never leaving cocoon.....PSYCHIDÆ (♀s in part)
52. With normal legs.....53
53. Cocoon seedlike, with a valve at one end (being formed of the larval case), the moth normally not leaving it.....PSYCHIDÆ (♀s in part)
53. Cocoon normally felted of the larval hair, or rudimentary and underground..54
54. Abdomen closely scaled, or spined, or with bristling dark gray hair GEOMETRIDÆ (a few ♀s)
54. Abdomen smoothly clothed with fine light woolly hair; moth not normally leaving the cocoon, which is composed of the larval hair LYMANTRIIDÆ (a few ♀s)
55. Fore wing with three or four unbranched veins only.....56
55. Fore wing with some branched veins.....57
56. A large eyecap.....OPOSTEGIDÆ
56. No eyecap.....HELIOZELIDÆ in part
57. A well-developed eyecap, fringed with overlapping scales; labial palpi small, cell slender or wanting.....58
57. Eyecap not developed,—at most with first joint of antenna large, a little hollowed on inner side, and fringed with a single row of bristles (pecten)...59
58. Cell very small, less than a tenth area of wing, or wholly absent; membrane aculeate.....NEPTICULIDÆ
58. Cell larger, membrane not aculeate.....LYONETIIDÆ
59. Maxillary palpi twice as long as eye, folded, conspicuous.....PRODOXIDÆ
59. Maxillary palpi shorter than eye, or porrect.....60

60. Vestiture of thorax of deep hair and spatulate hair, also similar on palpi and legs, the palpi usually strongly sexually dimorphic, large in both sexes; wings scaled, venation complete, with base of media preserved
TINEIDÆ (ANAPHORINÆ)

60. Palpi barely reaching middle of front or shorter, tongue absent; vestiture of thorax and tibiæ dense and hairy ..... (*Cossidæ* in part)

60. Thorax, at least, scaled or slender, palpi also in the majority of cases, and fore and middle tibiæ; often minute moths with lanceolate wings 61

61. Hind wing lanceolate, much narrower than its own fringe, fore wing much broader but also lanceolate 62

61. Hind wings with well-marked anal angle and rounded or somewhat pointed apex, not strongly concave below it; when narrower than fore wings, with three well-developed anals 76

61. Hind wings various in size with produced apex, strongly concave below apex, and again produced more or less on M_3 and Cu_1, with well-marked anal angle ..... most GELECHIIDÆ

62. Maxillary palpi present and folded in repose 63

62. Maxillary palpi obsolete, or three-jointed and porrect 65

63. Head extremely rough, with bristling vestiture 64

63. Head smooth-scaled, except narrowly behind ..... ACROLEPIIDÆ

64. Aculeate; R_1 of hind wing much stronger than base of main stem of R, and appearing as a basal fork of Sc ..... a few ADELIDÆ

64. Not aculeate; R_1 of hind wing no stronger than basal portion of Rs, well out from base, connecting Sc and R, which are closely parallel toward base
a few TINEIDÆ

65. Head very rough and bristly on both vertex and face, second joint of palpus with lateral bristles toward tip ..... TINEIDÆ (Tenaga)

65. Lower part of face, at least, smoothly scaled; palpus without bristles 66

66. Fore wing with four veins or less, either free or stalked, to costa from cell, and five or six veins to inner margin (R_3 running to outer margin)
some YPONOMEUTIDÆ

66. Fore wing with five veins to costa from cell or with only three or four to inner margin (R_3 to costa) 67

67. Vertex rough-bristled 68

67. Vertex smooth-scaled, or with a few erect scales behind 70

68. Accessory cell very large, extending nearly half-way to base of wing, fore wing with heavy spinules on base of Sc and base of cell ..... TISCHERIIDÆ

68. Accessory cell small, or more often absent; not aculeate 69

69. A of fore wing forked at base, costa of hind wing not lobed ..... BEDELLIA

69. A of fore wing perfectly simple, costa of hind wing strongly lobed, with the obscure basal parts of Sc and R closely parallel to the edge of the lobe
GRACILARIIDÆ

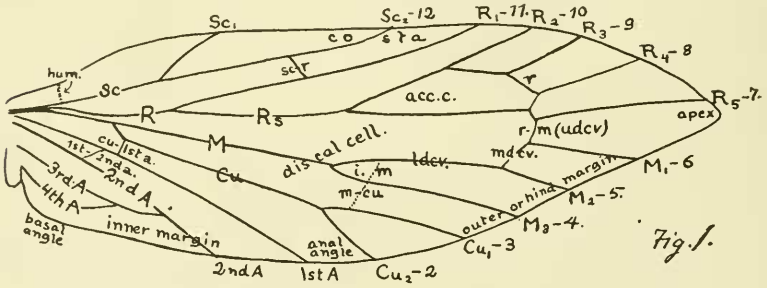
70. Sc and R of hind wing nearly straight and parallel toward base, usually connected by a distinct, but weak cross-vein R_1, a short distance out from base, in a few cases where Sc is very short, with R_1 independent of it, reaching the costa beyond its tip; when the costa is lobed with Sc fairly straight, and ending at the commencement of the concave portion 71

70. Sc and R sharply divergent at base, R_1 when traceable appearing as a basal fork of Sc, oblique, short, and heavy, and R_5 running nearly through the axis of the wing; or with Sc and R both obscure, closely parallel to the basal lobe of the costa, and R functionally replaced by the base of M.....72
71. Balpi upturned to vertex.....COSMOPTERYGIDÆ
71. Palpi minute, drooping.....HELIODINIDÆ
72. Maxillary palpi present, porrect.....GRACILARIIDÆ in part
72. Maxillary palpi absent.....73
73. Cu-stem of hind wing at least two-branched, palpi usually smoothly upturned to vertex, hind tibiæ loosely hairy.....ELACHISTIDÆ
73. Cu-stem of hind wing simple, free, no cell, or with very short palpi.....74
74. Basal joint of antenna broadened with overlapping scales (a rudiment of an eyecap), tongue weak, Cu of hind wing simple; hind tibia with a regular series of bristles.....*Lyonetiidæ* (*Phyllocnistis* in part)
74. Basal joint simple or with a slight pecten of bristles.....75
75. Palpi if upturned not reaching middle of front, usually hanging, HELIOZELIDÆ
75. Palpi moderately long and usually slender, upturned in life
GRACILARIIDÆ in part
76. Cu_2 of fore wing arising less than two-thirds way out on cell, most TORTRICIDÆ
76. Cu_2 of fore wing arising further out on cell.....77
77. Wing-membrane aculeate; Sc of hind wing with a strong basal fork (the lower fork being R_1), or considerably swollen at base, R and Sc usually sharply divergent from base, antennæ often extremely long, vertex very rough
ADELIDÆ in part
77. Wing-membrane not aculeate; antennæ never much longer than fore wing; R_1 rarely as strong as the other veins, and when distinct separated from the base of the wing by several times its length.....78
78. Maxillary palpi four- or five-jointed, folded.....79
78. Maxillary palpi porrect, three-jointed or rudimentary.....80
79. Head only slightly rough behind.....ACROLEPIIDÆ
79. Vertex with long bristly vestiture.....TINEIDÆ in part
80. M_1 and $_2$ of hind wing both absent.....TORTRICIDÆ (Carposina)
80. M_1 of hind wing present.....81
81. Labial palpi with bristles on side of second joint, or vertex and front both with extremely long rough vestiture, and second joint of palpus heavily tufted and third long; R and M_1 of hind wing widely separate..TINEIDÆ in part
81. Labial palpi without bristles, head with short, fairly smooth vestiture or third joint of palpus inconspicuous.....82
82. R and M_1 of hind wing widely separate at base, at least half as far apart as at margin.....87
82. R and M_1 of hind wing closely approximate or stalked.....83
83. Palpi as long as head, with second joint triangularly scaled, and third less than half as long normally porrect.....84
83. Palpi upturned to beyond middle of front often far beyond vertex, the third joint more than half as long as second, and upturned.....85
84. R_4 and $_5$ separate.....TORTRICIDÆ (PHALONIINÆ)
84. R_4 and $_5$ stalked, to costa.....GELECHIIDÆ (male *Anarsia*)

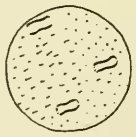
85. Veins of fore wing all present and R_5 running to outer margin
YPONOMEUTIDÆ in part
85. R_5 running to costa or lost....86
86. Fore wing with all veins from cell separately, hind wing wider, with R and M_1 long-stalked.... STENOMATIDÆ
86. Fore wing with R_4 and $_5$ stalked, the hind wing trapezoidal and usually wider, strongly rounded out at end of M_3 and Cu_1.....a few GELECHIIDÆ
86. Hind wing lanceolate, narrower than fore wing.....COSMOPTERYGIDÆ
87. R_2 arising at apex of cell, and M_3 and cubitals also closely crowded from lower angle, male usually with strong sexual modifications; five radials run to costa.....BLASTOBASIDÆ
87. R_2 arising less than nine tenths the length of the cell, and well away from the origin of R_3.....88
88. Five veins run from cell to costa in fore wing.....89
88. Four veins run from cell to costa in fore wing, R_5 ending decidedly below the apex.....90
89. Hind wing with M_2 arising decidedly nearer M_1 than M_3.....ETHMIIDÆ
89. Hind wing with M_2 arising decidedly nearer M_3 than M_1 or rarely half way between them.....ŒCOPHORIDÆ in part
90. R_4 and $_5$ stalked; ocelli rudimentary or absent.....ŒCOPHORIDÆ in part
90. With all veins of fore wing arising separately or (Allononyma) with R_4 and $_5$ stalked and large ocelli.....YPONOMEUTIDÆ in part

EXPLANATION OF FIGURES.

Fig. 1. Typical primitive Lepidopterous venation (*Eriocephala thunbergella*, with the addition, in dots, of a few veins lost in Eriocephala, but generally preserved), the veins numbered according to the Comstock-Needham and German systems.



Sc, Subcosta.
R, Radius.
M, Media.
Cu, Cubitus.
A, Anal.
hum, humeral cross-vein.
udcv, upper discocellular vein (cross-vein radius-media).



mdcv, middle discocellular vein (in this case, and usually, a portion of media-one).

ldcv, lower discocellular vein (the portion so marked is a portion of the stem of media one-plus-two, but as ordinarily defined the short cross-vein m. would also be considered part of it).

1st A is a concave vein, and when it becomes rudimentary is known as the submedian fold.

The veins, hum., Sc^{1}, sc-r, r, cu-1st a, 1st-2d a, and 4th a, are lost in almost all higher forms.

i, Intercalated cell (reckoned as part of the discal cell).

acc. c, Accessory cell (reckoned as part of the discal cell in micros- and butterflies, where it is more or less completely fused with it, but not in most moths, where it is perfectly separated, when present).

Fig. 2. Portion of bleached wing-membrane, showing points of attachment of scales and aculeæ.

THE ALIMENTARY CANAL OF A CERCOPID.

By J. C. Kershaw.

The following brief notes refer to *Tomaspis saccharina* Dist., a pest of sugar cane in Trinidad, West Indies, where the nymphs feed on cane roots and the adults on the leaves. In the nymph of this Cercopid the air, which all sucking insects doubtless imbibe in quantity along with the liquid food, appears to pass through the alimentary canal and be utilized in forming the air-bubbles coated with mucinoid which are emitted from the anus and form the froth in which the nymph lives. After examining this Cercopid I am the more inclined to believe that (as stated in a previous paper on Flata in Psyche) the "food-reservoir" in the head of Flata functions in part as an air-separator to rid the liquid food of superabundant air before it passes through the alimentary canal. In the Cercopid nymph, however, the air is directly utilized, as mentioned above. In this Cercopid and in Cicada the diverticulum or pouch of the midgut (forming the "food-reservoir" of the head in Flata and the filter-chamber of the thorax in Cercopid and Cicada) is almost filled up by the zigzag course through it of the posterior part of the midgut and the anterior part of the malpighian tubes. This diverticulum, pouch or filter-chamber is entirely situated in the thorax, as are also the diverticula of Perkinsiella and other Homoptera mentioned in the paper referred to above; only entering the head in Flata, Pyrops and Dictyophoro-